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REPORT OF THE UNIDO OAU-STRC CONSULTATIVE MEETING ON THE INDUSTRIAL UTILIZATION OF MEDICINAL AND AROMATIC PLANTS IN THE AFRICAN REGION*

Vienna, Austria
24 - 27 May 1983

* This document had been reproduced without formal editing.

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"Approche et Modalités d'Action pour l'Utilisation Industrielle des Plantes Médicinales dans les Pays du Tiers Monde " by M.A.Rakoto-Ratsimamanga (Madagascar)

"Industrial Utilization of African Medicinal Plants " by Prof.Xiao Peigen (China)

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"Production of Plant-derived Pharmaceuticals in the African Region" by Prof.F.Sandberg

"Industrial Utilization of African Medicinal Plants" by Prof.Dr.Dr.G.H.Mahran (Egypt)

"Considerations for the Development of a Medicinal and Aromatic Plants Industry within the African Region" by R.O.B.Wijesekera, Pharmaceutical Industries Unit, UNIDO

PART I. PLAN OF ACTION

1. INTRODUCTION

At the Third African Symposium on the Traditional Pharmacopoeia and African Medicinal Plants staged by the Organisation of African Unity-Science and Technological Research Commission (OAU-STRC) in Abijan (1979) it was recommended that Technical Meetings on:" Medicinal Plants, their Industrialization and Integration into Modern Medicine" be organised by UNIDO in collaboration with the OAU-STRC. The Abijan meeting had also recommended that two meetings one each for Anglophone and Francophone countries be organised. Further consideration of these recommendations by both OAU-STRC and UNIDO led to the idea that a Consultative Meeting on both African as well as international experts should precede other activities. Accordingly, such a meeting was organised by UNIDO and staged during 24 - 27 May 1983. Eight experts participated at this meeting, four of them from the African region and one each from;the People's Republic of China, India , Europe and Scandinavia. An Austrian specialist in this field was also invited to participate as an observer.Regrettably, representatives from WHO and ITC who were invited, and who had expressed a desire to participate, were unable to do so.

The Objectives of the Consultative Meeting as initially defined were the following:

(a) Formulation of future strategy and an action programme for the industrial utilization of medicinal and aromatic plants in the African Region, for the production of plant-derived pharmaceuticals and related preparations for therapeutic needs.

(b) Formulation of an appropriate approach to the staging of two Workshops on the Industrial Utilization of Medicinal Plants within the African Region.

(c) Formulation of project concepts which shall form the basis for soliciting financial assistance from funding agencies and other donors.

(d) Formulation of modalities for co-operation with other international organizations such as the World Health Organization.

(e) Agreement on modalities for follow-up action by OAU-STRC, UNIDO UNDP and WHO for assistance in this field to the African Region.

The Consultation commenced with a series of formal presentations by the experts (vide part III) and these were followed by discussions leading to the formulation of the recommendations in the sections 2 and 3 below.

2. GENERAL RECOMMENDATIONS

2.0 Preamble

In making the following general recommendations the Consultation was mindful of the fact that the industrial production of therapeutic agents based on medicinal plants was of considerable importance to the African Region. The Consultation emphasised that in several developing countries both in Africa and Asia up to 90% of the therapeutic requirements of the population were met by the use of herbal preparations; in the industrialised countries too, medicinal plants that had disappeared from official therapy, were being now used in self-therapy, as well as to generate industrially produced pharmaceutical preparations.

The consultation was strongly spportive of UNIDO's activities on the industrial utilization of medicinal and aromatic plants [1] and in formulating its recommendations the consultation noted the activities of several other UN agencies in this field, such as UNESCO and WHO and particularly the recommendations on medicinal plants made at the level of the WHO Regional Office for Africa [2] and the Resolution adopted by the 31st World Health Assembly [3] and the UNIDO Technical Consultation on the Production of Drugs from Medicinal Plants in Developing Countries [4].

The following are the general recommendations

2.1 that UNIDO in collaboration with OAU-STRC, UNESCO,WHO and ITC should use all possible resources at their command to promote and develop the production of therapeutic agents from Medicinal and Aromatic Plants in the African Region by:

(a) encouraging, supporting and developing African pharmaceutical production units preparing all forms of pharmaceutical preparations from medicinal plants growing in Africa, for enhancing the health-care programmes of the region

(b) promoting co-operation between African member states and industrial countries particularly in the technologies associated with the Pharmaceutical Industry

(c) encouraging and promoting the cultivation of African medicinal plants with a view to their industrial utilization

(d) facilitating the training of African scientists and technologists in recognised pharmaceutical organisations

(e) promoting research activities on African Medicinal and Aromatic Plants, leading to the production of plant-derived pharmaceuticals.

(f) enhancing the capabilities for semi-pilot and pilot-scale production of plant-derived pharmaceutical formulations , within the African Region.

2.2 that the"African Pharmacopoeia" being compiled by the OAU-STRC and now, nearing completion , should receive high priority as it represents the best medium through which plant-derived therapeutic preparations would get acceptability as useful therapeutic agents.

2.3 that UNIDO emphasise in their overall programmes within the pharmaceutical sector the industrial production of plant-derived therapeutic agents, and increase and enlarge their programmes of support and assistance, in the development and transfer of technologies , to developing countries in this field.

2.4 that UNIDO take a leading role in encouraging active collaboration with other agencies such as WHO, UNESCO, ITC, FAO and other appropriate bodies, within the sector of activities relating to the industrial production of medicaments based on traditional pharmacopoeias.

3. SPECIFIC RECOMMENDATIONS

3.0 Preamble

The Consultation resolved that there was a need for a set of specific recommendations for the several African nations that were at different levels of development.The Consultation was mindful of the fact that all African nations needed assistance in order to reach self-reliance and self-sufficiency with respect ot their pharmaceutical requirements.

The following specific recommendations were made:

3.1 that in order to achieve the objective of developing a medicinal-plant based pharmaceutical industry in Africa, and in order to provide for the Research and Development needs of such an industry, an International Centre for Research and Development of Medicinal Plants be established in an African country under the sponsorship of OAU-STRC. The Centre will be mandated by a charter, fully supported by UNIDO. Initiatives should be taken to secure funds for the planning of such a Centre through the agency of UNIDO and other agencies.The OAU-STRC in collaboration with UNIDO should work out the modalities for the establishment of this proposed Centre (vide Annex I)

3.2 that as a contingency measure for the <u>least developed</u> of the African countries, who continue to rely heavily on the traditional herbal preparations, the Consultation approved the model for assistance already worked out by UNIDO [5], [6]. The model seeks to assist these countries in the systematic cultivation of medicinal plants and subsequent processing of these plants in the form of standardised "teas" , and standard dosages of dried herbs in sachets, to provide for their national health-care programmes. This model is recommended for execution by UNIDO in collaboration with African countries and the OAU-STRC.

3.3 that in order to benefit the majority of African countries which are less developed in this field and for which considerable training is required, two workshops be held. Each workshop will have a theoretical as well as a production-oriented practical component; the workshops could be staged in suitable African countries (with relatively developed pharmaceutical facilities) in collaboration with OAU-STRC (vide annex 2).

3.4 that the UNIDO In-plant Group Training Programmes be continued as successfully , staged jointly by UNIDO, and the Joint UNIDO-Romania Centre in Bucharestin 1980,1982 and again in 1983; and that such Group Training Programmes be also instituted in other countries * willing to donate facilities and host them.

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* India , Egypt and Hungary were suggested as possible host countries.

ANNEXURE I

A PROPOSAL FOR AN INTERNATIONAL
CENTRE FOR RESEARCH AND DEVELOPMENT
OF MEDICINAL PLANTS

1. During the four day deliberations of the Consultative Meeting on Industrial Utilization of Medicinal and Aromatic Plants, the experts achieved unanimity on the need for establishment of an International Centre for Research and Development of Medicinal Plants under the sponsorship of OAU . Since it was strongly believed that such a centre would stimulate , catalyse and promote the rapid development of a sound medicinal and aromatic plant industry within the African continent .

The experts took note of the fact that the present annual import bill of the African countries with respect to drugs and pharmaceuticals is of the order of US$ 15 billion (US$ 15×10^9).As national health programmes gain momentum this figure is likely to increase further. This objective reality is coupled with the fact that there barely exist any organised African Pharmaceutical Industry to meet the demand of drugs for the health care systems .Nearly 90% of the African population has no access to medical aid or ethical drugs .The experts felt that in the absence of any wide spread chemical industry on the continent, the only indigenous raw materials for the pharmaceutical industry available to African countries is its rich medicinal plant flora. This raw material is at present in many instances exported to advanced countries to be reimported in the form of high value finished pharmaceutical products.Thus the potential of this raw material as far as industrial development and medical needs of African countries are concerned, remains at present untapped in a manner that will bring total benefits to the African continent.

The promotion, development and improvement of plant-based medicaments has also from time to time been recognised as an important activity for support by UNIDO and other UN agencies such as FAO,UNESCO and WHO not only for Africa, but for all developing countries . A strong plea for promotion and production of drugsderived from medicinal plants, has

also come from OAU whose member countries are keen to utilise their own resources to achieve a certain degree of self-reliance in this vital health-care related industry which also offers a large employment potential.

The experts felt that the rapid development of a medicinal plants industry in Africa can take place only if there is a centralised promotional agency which can, inter alia

- systematically explore and survey resources
- identify commercially exploitable medicinal plants
- develop agro-technology, post harvest technology and technology for processing of crude botanicals to safe reliable and standardised medicaments.

The Consultative Meeting accordingly proposed the creation of an International Centre for Research and Development of Medicinal Plants .Such a Centre to be co-sponsored by UNIDO and the OAU-STRC and mandated to carry out the following activities (see fig.1):

(i) to promote the large-scale cultivation of medicinal plants to ensure a steady supply of raw material of consistent quality.

(ii) to assist in adapting technology to convert such raw material into herbal teas, extracts in a form required to meet primary health care needs at low cost.

(iii) to adapt and develop technologies to convert raw material to high value phytochemicals such as alkaloids,glycosides,etc. and to prepare modern ethical products from the active constituents of plants in the African Pharmacopoeia.

(iv) to carry out R and D on herbal drugs with a view to scientifically assessing biological activity or therapeutic claims, and to prepare ethical products based on scientific methods.

(v) to undertake all such steps which will ensure that the raw materials which are at present exported are processed , as far as possible, within Africa.

(vi) to take steps to promote and popularise herbal drugs.

(vii) to generate education and training facilities both for rural and urban phytotherapy as well as to generate technical manpower required for a medicinal plant industry.

(viii) to undertake surveys of the flora and to collect ethnopharmacological information.

(ix) to survey diseases common to or peculiar to Africa and identify herbal remedies for such diseases.

(x) to take steps to ensure safety, particularly from the toxicological angle, of herbal drugs prepared and used in Africa.

(xi) to develop information and establish a computerised data bank to assist overall development of this industry.

(xii) to undertake introduction of exotic medicinal plants which furnish commercially valuable pharmaceuticals with expert potential.

ORGANOGRAMM OF THE PROPOSED INTERNATIONAL CENTRE FOR THE RESEARCH AND DEVELOPMENT ON MEDICINAL PLANTS

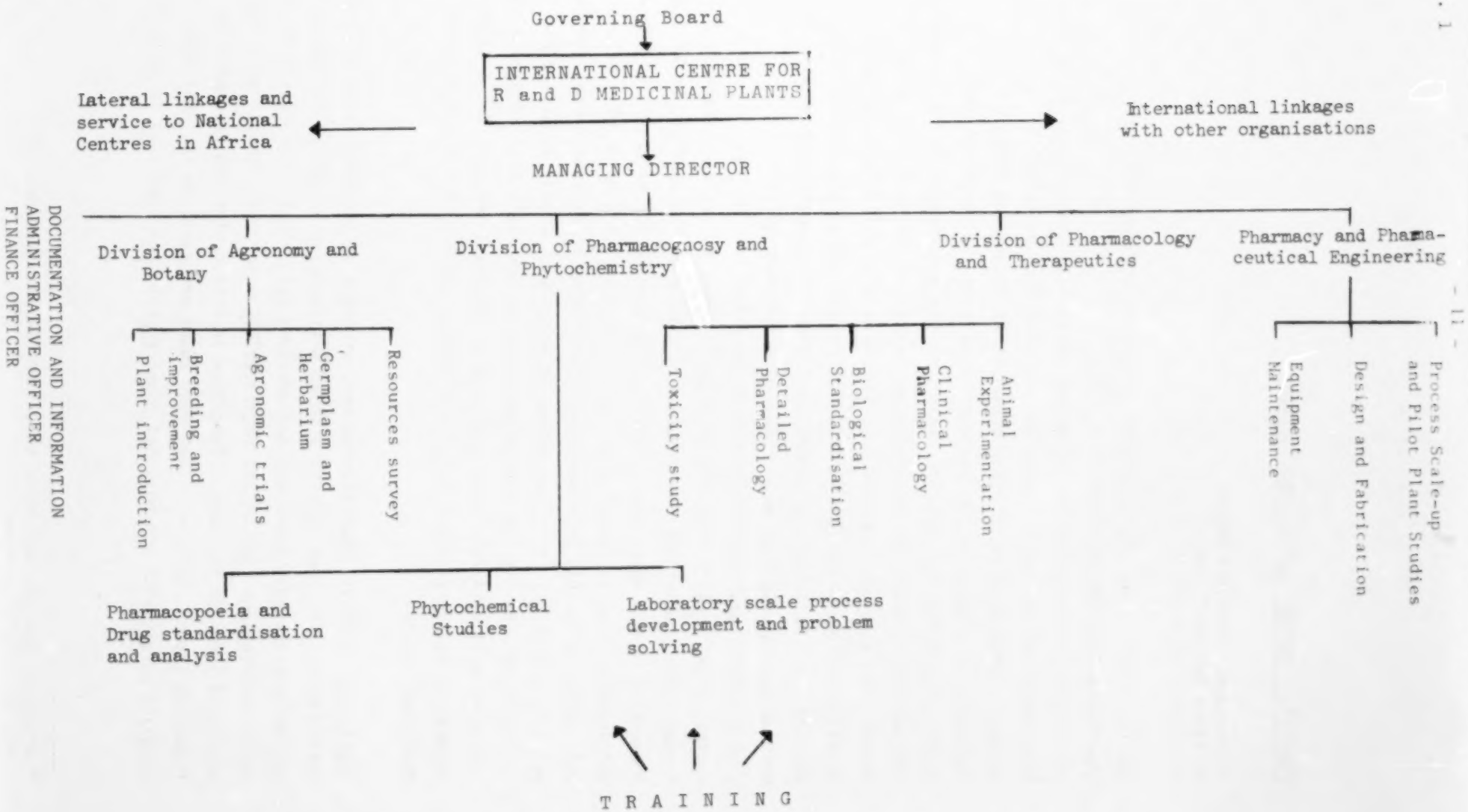


Fig. 1

PART II. REPORT ON THE PROCEEDINGS

Rapporteur: Prof.G.H.Mahran
assisted by: Dr.C.K.Atal

The Consultative Meeting commenced on Tuesday 24th May 1983 at the Vienna International Centre .
Dr.R.O.B.Wijesekera, Special Technical Adviser ,Pharmaceutical Industries Unit, welcomed the participants .He conveyed the apologies of Dr.Mrs.A.Tcheknavorian, Chief,Pharmaceutical Industries Unit, who was unable to be present as she was away on mission. Dr.Tcheknavorian's mission dates had been already fixed with the governments of the countries she was due to visit and she very much regretted her inability to be present. He also conveyed the best wishes of Mr.D.G.A.Butaev, Director, Division of Industrial Operations, for the success of the Consultative Meeting.* Dr.Wijesekera also mentioned that the present Consultative Group Meeting had materialised as a result of persistant efforts of Prof.A.O.Williams,Executive Secretary OAU-STRC, over the last eighteen months. Dr.Wijesekera then requested Dr.Williams to act as chairman and to make some preliminary observations on behalf of the OAU-STRC.Dr.Williams commenting on the importance which OAU attaches to the programme on Medicinal and Aromatic Plants, stated that OAU itself grants a quarter of a million US$ annually to this programme. As a first step an African Herbal Pharmacopoeia was bein compiled , the first volume of which was already finalised and the second volume was nearing completion.Plans to translate this monograph into French as well as Arabic were under way.He stressed the need for a clearcut pharmaceutical development policy for Africa based on the utilization of Medicinal Plants.

Continuing, Prof.Williams pleaded very strongly on the need for this Consultative Meeting to come forward with an action-oriented set of recommendations and to supplant past ideas and declarations with concrete proposals.It is with these expectations that he had requested UNIDO to locate people with expertise who could identify the tasks, formulate an action plan and recommend the financial inputs. He hinted that when funds are given to National Institutes, this aid merges with the national plans whereas the real need is to support

* Mr.Butaev,who was unable to be present at the opening, later met the experts personally.

an all-African plan of action which should be geared to achieve self reliance in the area of medicinal plants as distinct from the healing art.The emphasis should be to develop galenical and ethical products.

At this stage, the Chairman invited suggestions for Rapporteur and the name of Prof.G.E.D. Mahran was proposed as rapporteur and Dr.C.K.Atal as supporter.

The Chairman then requested Prof.Mahran to deliver the keynote address on the topic "Industrial Utilization of African Medicinal Plants " .The main points that Prof. Mahran raised in his address were the following:

1. Use of herbals in African medicine is of great antiquity although Africa has been a late starter in scientific investigations;nevertheless many important herbal drugs have by now been well studied;
2. The wide spectrum of African herbal products can be classified into the following categories:

A	Herbal teas
B	Extracts and galenicals
C	Aromatic oils
D	Fixed oils, fats and waxes
E	Insecticides, pesticides
F	Contraceptives
G	Gums and resins
H	Colouring matters
I	Marene and aquatic plants

Prof.Mahran listed the more important raw materials of African origin which can furnish high value processed materials such as colchicine,tropane alkaloids,xanthotoxin,ouabain,capsaicin, berberine, rutin, reserpine, strychnine, piperine, khellin, ammoidin and vinca alkaloids. Prof.Mahran pointed out that for industrial utilization of these raw materials there was a strong and urgent need for the more sophisticated process technology available in Western countries.

During the discussion that followed Dr.C.K.Atal pointed out that besides the highly sophisticated equipment and western technology, alternate appropriate technology available in other developing countries may be more relevant in the African scene.

Prof. Rakoto-Ratsimamanga pointed out that instead of isolating pure active principals, which often becomes quite expensive, crude factions which are

chemically standardised, may offer a cheaper source of drugs in African continent, as pointed out by UNIDO itself in the review on its programmes in this sector (Ref. 1)

Prof.Williams experessed his views even favouring high technology,which some of the countries in Africa would be quite capable of absorbing . The Chairman also raised the issue namely that modern practitioners of medicine in Africa have access to Western text books and ideas, and have been trained in the West.They are therefore loathe to use herbal medicines of which they have scant knowledge. To overcome this impediment and to ensure, popularise and bring in ethical and scientific respectability in the use of herbal drugs as healing agents, the Consultative Meeting suggested some measures which may be considered. They are as follows:

- integrated medical education in which herbal medicine is also tought in modern medical schools (Prof.F.Sandberg)
- possibility of having schools exclusively for imparting education in herbal medicine (Prof.Wagner)
- assigning official status to herbal remedies, their proper chemical or biological standardistation and generating toxicological data (Dr.C.K.Atal) so that the modern practitioner is assured of therepeutic products with efficacy and freedom from toxicity

The next presentation was by Prof.Rakoto-Ratsimamanga.

The main points were:

The availability of raw material such as:

200 tons Rauwolfia vomitoria
200 tons Rauwolfia cenfertiflora
400 tons Cantharanthus
70 tons Yohimbe bark
200 tons Lehegium africanum
60 tons Grefonia
4 tons Gloriosa

---- Centella asiatica
---- Cinchona

He advised restraint in growing medicinal plants in reasonable quantities on a large scale where there may be difficulties, in many instances, concerning the selling of the raw materials due to some other countries starting production

of what is already pruduced. However it is important to develop indigenous processing facilities so that one is not dependent on buyers.

The next presentation was given by Prof.E.O.Ogunlana on "Medicinal and Aromatic Plants in the African Region". Prof.Ogunlana emphasised the need to have judicious selection of suitable land ; scientific management of the farm; ensuring water resources and solvents; developing or having access to reference herbaria; conception for quality control and standardisation. He also distinguished between what is called " traditional medicine " as opposed to "traditional healing" and said the Consultation's should be drawn exclusively to the forme . Prof.Ogunlana pleaded strongly that this Cosultative Group should recommend a manpower training mechanism at national, African and international level.

The last presentation for the day was given by Prof.Finn Sandberg who spoke on "Production of plant-derived pharmaceuticals in the African Region". The main highlights were the following:

- The infrastructure in different African countries is very different
- In least developed countries, as for instance TOGO, even ensuring availability of correctly identified plant material packed in plastic bags with instruction about dosage and use, can go a long way to meet health needs of the people.
- Multipurpose pilot plants can form a good starting facility for R and D towards industrial exploitation of medicinal plants
- Each country cannot do everything and there should be some understanding and specialistion between different countries under OAU

During the discussion that followed the Chairman Prof.Williams stated that he fully endorsed the views of Dr.Sandberg in suggesting different solutions to industrial utilization of medicinal plants based on the various levels of development of the African nations.He commended this approach to the Consultative Meeting.

The Morning Session on Wednesday 25th May commenced with the following presentations: Prof.H.Wagner, Prof.Xiao Peigen, Dr.C.K.Atal and Dr.Wijesekera followed by discussions. The main points of each presentation were as follows:

Prof.H.Wagner

"Strategies for Development of Medicinal Plants in Africa"

The African Pharmacopoeia should receive high priority as it is the only medium through which a drug gets acceptablility as a useful drug. The monographs included in the pharmacopoeia should include standards of quality.

Prof.Wagner pleaded for compilation of a text book on African Plants. According to him this book will serve as a medium of teaching phytotherapy.

He suggested processing of ruta graveolens, obtaining strophanthin from strophanthus, hyoscyamine from hyoscyamus, clove oil from cloves, as typical examples which African countries should attempt to accomplish as the technology was well known. Prof.Kubelka agreed with these observations though he opined that there could be discussion on the examples cited.

Prof.Xiao Peigen

There are 3000 medicinal plants in Africa . Out of these there are 50 drugs which are of reputed medicinal value not only in Africa but also in other countries.

Prof.Xiao Peigen recommended the following candidate-drugs for detailed investigation:

commiphore africana - antilipidemic and antiarthritis
asclepias currasavica- caridotonic
melia azadirachta - antiplasmodial
securidaca longepedunculata - rheumatic diseases/sedative

and several others stated in the complete text.

Prof.Xiao Peigen recommended strongly collection of ethnopharmacological data because of the danger of such experiences and knowledge being lost.He mentioned that such knowledge exists in the hands of a few old experienced masters of phytotherapy.

Selection of most appropriate research objects or specific plants : He mentioned that the basis for such selections should be the plants whose use is established c linically such as:

combretum
melia azadirachta
veronica amygsalina
zanthoxylum zanthoxyloides

Activity should be established by modern research,and in research there should be emphasis on those diseases which are peculiar to or commonly occur in Africa.

Prof.Xiao Peigen showed the Chinese Booklet for barefoot doctors.

It is low priced; 1.5 million copies have been distributed and it contains 200 medicinal plants descriptions under the heads

vernacular name
botanical name
plant description and identification
dosage and clinical results

Dr.C.K.Atal

"Strategies and Requirements for Industrial Utilization of Medicinal and Aromatic Plants in Africa "

He elaborated on the criteria to be applied on classification of African countries based on their level of development , financial resources, infrastructure availability and socio-political set-up of government.

Dr.Atal outlined the role that the government can play at the countrylevel to promote, help develop medicinal and aromatic plant industry.

Dr.Atal emphasised the need for a data bank and information centre.Such a centre could advise and forecast information to growers and processors.

Dr.Atal emphasised the need for a strong training and research facility.

According to him , OAU and UNIDO could arrange:

- training and exchange of workers
- identification of plants for detailed investigation and commercial exploitation
- preparation of production programmes
- deciding choice of technology and locating services of technology and equipment

As practical steps Dr.Atal emphasised the setting up of an

- African R and D training centre
- a school of phytotherapy
- a production factory on semi commercial scale
- demonstration centres for cultivation of medicinal and aromatic plants
- extraction and pilot-plant facilities

Dr.R.O.B.Wijesekera

"Considerations for the development of a medicinal and aromatic plants industry within the African region"

He mentioned that factors which must be considered within the mandate of this meeting are :

- development of an industry that caters to the primary health care of African countries
- such industry should have varying degrees of sophistication suited to the particular needs and levels of development of countries where such industry is located

Dr.Wijesekera mentioned the example of Nepal where activities such as economic mapping of flora, cultivation technology and standardisation of herbs/extracts had been emphasised in the UNIDO assisted programmes. He was in favour of multipurpose pilot plants and ensuring study of biological efficacy and lack of toxicity.

Dr.Wijesekera stated that the UN-system has a multi-facet interest in medicinal and aromatic plants through its various agencies as for example:

UNIDO - Industrial Production of Pharmaceutical Agents and Building of Competence .

FAO - Cultivation

UNESCO- Training, Education and Research

WHO - Introduction of medicinal plants in pirmary health care

Discussions:

Commencing the discussions, Prof.Williams reiterated that the international experts should assist OAU-STRC in defining a clearcut pharmaceutical development policy, for itself , based on the use of the natural resource of medicinal plants.

Both, formal and informal discussions followed and led to the formulation of a Plan of Action part I of this report.

ANNEXURE II

A PROPOSAL FOR THE STAGING OF TWO WORKSHOPS IN THE AFRICAN REGION ON:

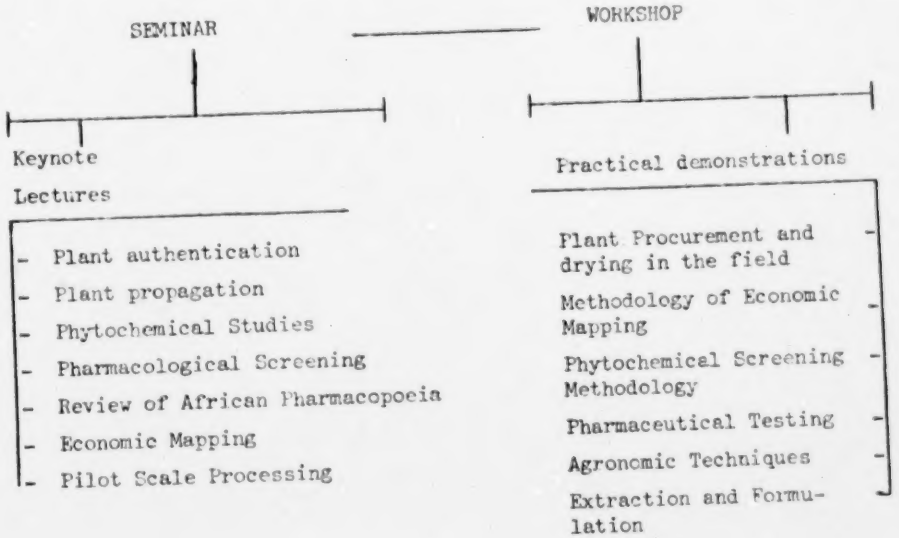
THE MEDICINAL AND AROMATIC PLANT-BASED INDUSTRY

1. The staging of two Workshops within the African Region was one of the major recommendations at the Third Inter-AFrican Symposium on the Traditional Pharmacopoeia and African Medicinal Plants in Abijan in 1979. For a veriety of reasons, chiefly, the non-availability of funds, these meetings could not be staged. Subsequently, in discussions between UNIDO officials and representatives of the OAU-STRC , it was felt that the Consultation should discuss:

"The formulation of an approach to the staging of two Workshops on the Utilization of Medicinal Plants within the African Region " .

2. Having discussed the various possibilities the consultative meeting decided that there should be staged, at least two Seminar-cum-Workshops, within the African Region.These Workshops should possess the comonents of a regional seminar, as well as that of a practical workshop, which would enable participants to gather first hand knowledge of the practical steps involved in the utilisation of medicinal plants.

3. Thus the Seminar Workshop would be constituted as follows (vide diagram below)



Each Seminar-Workshop would be expected to last about 4 - 6 weeks and the practical Workshop would last two weeks, making a total time of between 6 - 8 weeks.
The Seminar - Workshops would have to be held one each in an Anglophone and a Francophone African Country which possess the infra-structure and personal to organise and host it. The Keynote Addresses could be delivered by invited African as well as International Experts.

4. Cost Estimates for each Seminar - Workshop would be as follows:

(i)	Travel and subsistance (5-7 days) for 8 African and International Lecturers for Seminar Keynote Lectures	..... US$	35.000
(ii)	Travel and Subsistance for 15 Participants from African member states	..... US$	100.000
(iii)	Grant-in-aid to Host Institution for setting-up practical demonstrations etc.providing facilities	..... US$	25.000
(iv)	Salary, Travel , subsistance for planning officer, Seminar - Workshop	..... US$	10.000
	TOTAL	US$	182.000

N.B. These cost estimates are only very approximate and detailed estimates would have to be compiled depending on venue etc.

UNIDO-OAU/STRC Consultative Meeting
on the Industrial Utilization of
Medicinal and Aromatic Plants
Vienna, Austria, 24 - 27 May 1983

APPENDIX 1

DOCUMENTATION

1. Approche et Modalités d'Action pour l'Utilisation Industrielle des Plantes Médicinales dans des Pays du Tiers Monde (expérience originale de l'Institut Malgache de Recherches Appliquées, Centre Régional de Recherches de l'Organisation de l'Unité Africaine - Antananarivo, Madagascar
Albert Rakoto-Ratsimamanga et Suzanne Ratsimamanga, Institut Malgache de Recherches Appliquées, Antananarivo, Madagascar

2. Medicinal and Aromatic Plants in the African Region
Prof.E.O.Ogunlana, Faculty of Pharmacy, University of Ife, Ile-Ife, Nigeria

3. Industrial Utilization of African Medicinal Plants, Prof.Xiao Peigen, Institute of Materia Medica , Chinese Academy of Medicinal Sciences, Beijing

4. Strategies and Requirements for Industrial Utilization of Medicinal and Aromatic Plants, Dr.C.K.Atal, Director, Regional Research Laboratory, Jammu, India

5. Markets for selected
MEDICINAL PLANTS AND THEIR DERIVATIVES
UNCTAD/GATT

6. Considerations for the Development of a Medicinal and Aromatic Plants Industry within the African Region
R.O.B.Wijesekera, Special Technical Adviser, Pharmaceutical Industries Unit, UNIDO

7. Production of Plant Derived Pharmaceuticals in the African Region
Prof.Finn Sandberg, Professor of Pharmacognosy, University Uppsala Sweden

8. Industrial Utilization of African Medicinal Plants
Prof.Dr.Dr.G.H.Mahran, President , African Pharmacopoeia Committee Organization of African Unity OAU/STRC.

9. Report, Workshop on the Pharmaceutical Industry(combined modern-traditional Pharmacy) for Promoting Technical Co-operation among the Developing Countries, Beijing and Hangshou ,1 - 14 November 1982

10. Traditional Pharmacopoeias Revisited : A resumé of the goals and philosophies underlying UNIDO's programmes in the industrial utilization of medicinal and aromatic plants in developing countries, Pharmaceutical Industries Unit, UNIDO

11. Work Programme of the JOINT UNIDO-ROMANIA CENTRE for the Valorization of the Medicinal and Aromatic Plants available in African Developing Countries

12. World Demand for Medicinal Plants, its Standards and Requirements" Report held by Horst Müggenburg on the occasion of the international seminar on medicinal plants, phytochemicals and bulk drugs , New Delhi, March 22 - 25

13. Basic Document for the Selection and Characterization of Medicinal Plants (Vegetable Drugs) , Professor Guiseppe Penso, WHO, Geneva

14. Report, Technical Consultation on Production of Drugs from Medicinal Plants in Developing Countries, Lucknow, 13 - 20 March 1978

15. Paper , University of Illinois at Chicago , College of Pharmacy Value and Utility of NAPRALERT

16. Medicinal and Aromatic Plants for Industrial Development, A.Tchoknavorian-Asenbauer, R.O.B.Wijesekera, UNIDO

17. Report ,Workshop on the Essential Oil Industry organised jointly by UNIDO and the Government of India with collaboration of ESCAP Lucknow, 21 November -3 December 1981

APPENDIX 2

UNIDO-OAU/STRC CONSULTATIVE MEETING ON THE INDUSTRIAL UTILIZATION OF MEDICINAL AND AROMATIC PLANTS
VIENNA, Austria 24 - 27 May 1983 (UF/RAF/82/208)

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APPENDIX 3

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